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(54) **Crane truck.**

(57) The object of the invention is a crane truck with its chassis (1) being supported on at least one axle (6) fitted with wheels, particularly with steering wheels (5). In order to simultaneously guarantee the advantages of both of the constructions in which the chassis (1) is supported at two separate points, or is supported at only one median point on the axle (6) which particularly is a steer axle, the axle (6) that carries the steering wheels (5), is fitted with one or more longitudinal arms (14) which are articulately connected (at 13) to the chassis (1), so as to be allowed to oscillate about a horizontal axis extending transversally to the chassis (1), and about a median longitudinal axis, the chassis (1) being supported through a respective elastic suspension member (12) on the said axle (6), at two spaced apart points (107, 207) thereof. The invention further provides for each suspension member (12) to be integrated into one unit, in combination with a device (26) for preventing a crane truck turnover, and with means (24) for limiting the upward travel of the chassis (1).

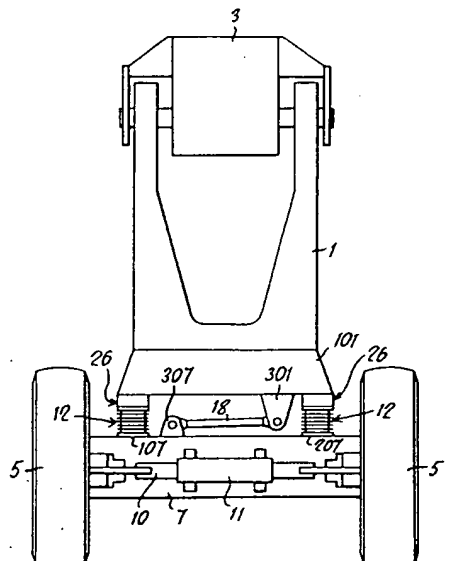


Fig. 2

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The object of the invention is a crane truck, particularly a crane truck with its chassis bearing on at least one axle fitted with steering wheels. In this disclosure, and in the following claims, by the term "longitudinal" we mean the longitudinal direction of the crane truck, that is, of the chassis thereof.

The invention aims to provide a crane truck with its chassis being fitted with such suspensions that a very good lateral stability of the crane truck is ensured by the use of not much expensive, extremely simple structural means of limited overall dimensions, as well as an adequate safety against a crane truck turnover, and a suitable springing and an optimum steerage of the crane truck, which allows its wheels to be steered over very great turning angles, being at the same time ensured.

This object is attained by the invention with the provision of a crane truck, in which one axle of its chassis, particularly the axle that carries the steering wheels, is fitted with one or more longitudinal arms which are articulately connected to the chassis so as to be allowed to oscillate about a horizontal axis extending transversally to the chassis, and about a median longitudinal axis, the chassis being supported through respective suspension members on the said axle, at two spaced apart points thereof.

The axle is preferably fitted with only one longitudinal arm arranged in the middle thereof, which is articulately connected to the chassis, coaxially to the chassis median longitudinal axis, and the two points at which the chassis is supported on the axle, are symmetrically located relative to the chassis median longitudinal axis, and therefore relative to the barycenter of the axle.

The said axle preferably is the crane truck rear axle that carries the steering wheels.

The elastic suspension members may be of any suitable type, and any be, for example, in form of helical spiral springs of steel, cylindrical spiral springs of rubber, hydraulic cylinders, or the like.

According to one preferred embodiment of the invention, each elastic suspension member is integrated into one unit further comprising a device for preventing a crane truck turnover, and possible means for limiting the upward travel of the crane truck chassis from the axle.

According to a particularly advantageous embodiment of the invention, the elastic suspension members consist each of a set of springing discs of an elastic material, such as rubber or plastics material, with holding discs of metal, for example of steel, being interposed between the said springing discs. The crane truck turnover-preventing devices are each in form of an elastic member having been pre-loaded in the direction in which the chassis is lifted from the axle, the elastic members being pre-

loaded to such a degree that is surely higher than a predetermined, crane truck turnover-preventing minimum safety load, and that causes the chassis to be lifted away from the axle, means for detecting such an uplifting of the chassis, and adjustable means for limiting the upward travel thereof, being respectively associated with the said devices.

The advantages as afforded by the invention, primarily reside in an extremely simple construction, and so in a low manufacturing cost, as well as in an easy and quick manner of carrying out any maintenance work, such as the replacing of the elastic suspension members.

From the functional standpoint, the suspension according to the invention, allows to combine the advantages of the known suspensions having four supporting points, that is, with the chassis being supported at two points on the steer axle, with the advantages of the known suspensions having three supporting points, that is, with the chassis being supported at only one point on the steer axle, the drawbacks of these known suspensions being thus eliminated. In the first instance, these advantages actually reside in a very good lateral stability of the crane truck, however with problems of a constructional character and a limitation in the crane truck wheels turning angle being implied. In the second instance, an optimum steerage of the crane truck is afforded, owing to its wheels being steerable over very great turning angles, but the fact that the chassis is supported at only one point, does reduce the lateral stability of the crane truck.

In accordance with the foregoing, the crane truck of the invention has a very good lateral stability, and affords an optimum steerage which allows its wheels to be steered over very great turning angles, without the crane truck stability being compromised, all that at a low constructional expenditure. The particular embodiment of the suspension members and the associated crane truck turnover-preventing devices, which are both integrated into one respective unit, allows to considerably reduce the overall dimensions thereof, and to suitably adjust the thresholds of operation of the crane truck turnover-preventing system, so that the crane truck is rendered considerably safer.

Also other features further improving the above-disclosed crane truck, form the object of the invention and are the subject of the dependent claims.

The particular features of the invention, and the advantages arising therefrom, will appear more in detail from the specification of one preferred embodiment thereof, which is shown by way of a non-limiting example in the accompanying drawings, in which:

Figure 1 is a diagrammatic side view showing a crane truck according to the invention.

Figure 2 is a view showing the rear end side of the crane truck according to Figure 1.

Figure 3 is an enlarged view of a detail of the rear axle of the crane truck according to Figures 1 and 2.

Figure 4 is a top view showing the rear axle according to Figures 1 to 3.

Figure 5 is a view showing the rear end side of the rear axle according to Figure 4.

Figure 6 is an enlarged view showing the articulation of the axle with the chassis.

Figure 7 is an axial sectional view showing an integrated unit comprising a suspension member and a crane truck turnover-preventing device.

Referring to Figures 1 and 2, there is shown that the crane truck according to the invention, has a chassis 1 that carries an operating cab 2, and a crane boom 3 fitted with lifting devices 4. The boom 3 is pivotally connected to the rear end region of the chassis 1. The front portion of the chassis 1 is supported by one or more wheels 5', and the rear portion thereof is supported by two wheels 5. The rear axle, which as a whole is designated by reference numeral 6, carries the wheels 5 that are the steering wheels, by means of a steering system which is controllable from the operating cab 2.

As it clearly appears particularly in Figures 4 and 5, the axle 6 is in form of a strong beam 7 arranged transversally to the chassis 1. Fitted at both ends of beam 7 are the pivots 8 for the steer spindles, each one of which supports the respective steering wheel 5. Each steer spindle pivot 8 is connected through a steering arm 9 to one end of a transversally extending steering rod 10 that is controlled by an actuator 11, particularly by a steering cylinder, or the like.

According to the Figures, the chassis 1 is formed with a rear extension 101 which through elastic suspension members 12 and the associated crane truck turnover-preventing devices 26, is supported on beam 7 at two points 107 and 207 thereof. The two points 107, 207 are spaced apart from each other, and are symmetrically disposed relative to the median longitudinal axis of the chassis 1, i.e., to the middle of beam 7. By means of a longitudinal arm 14, the beam 7 is articulately connected at 13 to the chassis 1. The longitudinal arm 14 may be fastened to the beam 7, for example by welding, or it may be even made of one piece therewith. Between the longitudinal arm 14 and the beam 7 several stiffening plates 214 may be provided, which help in increasing the said arm fastening strength.

The articulation means are so provided that the beam is allowed to oscillate in the vertical direction about a horizontal axis being parallel thereto, and

to oscillate about the longitudinal axis of arm 14. More particularly, and as shown in Figure 4, the means for articulately connecting the longitudinal arm 14 to the chassis 1, is in form of a transversally arranged pivot 15 which by two plates 16 is supported on the chassis 1. Through a ball bearing 17 an extension 114 for fixedly securing the longitudinal arm 14, is engaged with pivot 15. This allows the longitudinal arm 14, and so the beam 7, to perform the above-disclosed oscillatory movements.

The beam 7 and the chassis 1 are interconnected by a link 18 which by the ends thereof is articulately connected respectively to the beam 7 and the extension 101 of the chassis 1. The link 18 is eccentrically articulated to the beam 7 and the supporting extension 101, on opposite sides relative to the center line of beam 7. The means for articulately connecting the link 18 to the beam 7 and to the extension 101 are preferably made in a similar manner as the means for articulately connecting the longitudinal arm 14 to the chassis 1, and are shown in Figure 6. These means are each in form of a pivot 19 arranged longitudinally of the chassis 1, and carried by ear pairs 307, 301, respectively provided on the beam 7 and the extension 101. The ends of link 18 are each engaged through a ball bearing 20 with the respective pivot 19. The link 18 is thus allowed to oscillate either in a substantially vertical plane, or in any other direction.

According to Figure 7, the two suspension members 12, which are respectively associated with one point 107, 207 at which the extension 101 is supported on beam 7, consist each of a set of springing discs 21. The springing discs 21 are preferably made of rubber or plastics material having adequate elastic properties for the loads to which the crane truck is subjected. Interposed between every pair of successive springing discs 21 is a holding disc 22 of metal, particularly of steel, whereby the peripheral bulging is reduced of the springing discs 22 under the compressive action of a crane truck load. The pack consisting of springing discs 21 and the interposed holding discs 22, is bored through the center thereof, and is threaded on a stud 23 connecting the beam 7 to the respective area of the extension 101 of the chassis 1. The connection stud 23 is made integral with the beam 7, and the extension 101 is so mounted as to be slidable on the said stud, means 24 for limiting the upward travel of extension 101, which advantageously are of the adjustable type, being fitted on the upper end of the connection stud 23. In the shown example, the said means that limit the upward travel of the extension 101 from beam 7, consist of: an abutment member 124 that cooperates with the upper side of the extension 101, a

shockproof pad 25 interposed between the extension 101 and the said abutment member 124, a split stop ring 224 screwed on the threaded free end of the connection stud 23, and provided with a screw 324 for the said ring 224 to be tightened on the connection stud 23.

A separate crane truck turnover-preventing device, generally designated by reference numeral 26, is also interposed between each of the suspension members 12 and the extension 101. The said crane truck turnover-preventing device consists of a bushing 226 threaded on the connection stud 23, which by its lower end bears on the suspension member 12, and by its upper end bears against the extension 101. Cup springs 126 also threaded on the connection stud 23, are received in bushing 226. With the crane truck in normal operative conditions, the cup springs 126 are pre-loaded in the direction in which the extension 101 is lifted away from beam 7. Upon the crane truck load on the associated point 107, 207 - at which the extension 101 is supported on beam 7 by means of the respective suspension member 12, having reached a predetermined, crane truck turnover-preventing minimum safety value, the cup springs are pre-loaded to such a degree that these springs will overcome the said load, and by acting on the associated area of extension 101, will lift this extension away from beam 7, and then away from the suspension member 12. Such an uplifting is stopped by the means 24 for limiting the upward travel of the extension 101. Associated with each crane truck turnover-preventing device 26 are means 27 for detecting the upward travel of the extension 101, which signal the uplifting thereof to a crane truck turnover-preventing safety system, whose operation is known, and which may be of any suitable type.

As shown in Figure 7, the means for detecting the upward travel of the extension 101 from beam 7 is in form of a switch with its body 127 being integral with the extension 101 at one of the two points 107, 207 at which this extension is supported on beam 7, while the switching members 227 are adjustably engaged with the crane truck turnover-preventing device 26.

From the above disclosure and from the Figures, the advantages of the crane truck according to the invention, become clearly apparent. These advantages primarily reside in the combination of the advantages as afforded by the crane trucks whose chassis is supported at only one point on the steer axle, with the advantages of the crane trucks whose chassis is supported on the steer axle at two spaced apart points thereof, so that the drawbacks of both of these two constructions are at the same time eliminated. Thus, the crane truck of the invention has a very good lateral stability, and

its wheels are steerable over very great turning angles. This is attained thanks to an extremely simple and not much expensive construction. By the integration into one structural unit of the suspension member provided in each point at which the extension 101 of chassis 1 is supported, and of a crane truck turnover-preventing device which is associated with means for limiting, and means for detecting the upward travel of the chassis extension 101, a considerable saving in the overall dimensions is attained, while an easy and quick replacement of any member, particularly of the elastic suspension members, can be carried out. The elastic suspension members in form of sets of springing discs alternated with holding discs, further help to ensure an efficient springing action, jointly with a very good lateral stability of the crane truck. The particular embodiment of the crane truck turnover-preventing devices also ensures a precise adjustment on the crane truck of the threshold of actuation of the locking systems for preventing a crane truck turnover, and guarantees a decided triggering into actuated condition of the means for detecting the upward travel of the chassis extension 101.

Of course the invention is not limited to the just described and shown embodiment, and the same may be widely changed and modified, the more so in construction. The suspension according to the invention, is not limited to the application to a steer axle, and the same may be also applied to other types of vehicles or machines with similar problems. The crane truck chassis may be supported on the steer axle even at any suitable number of chassis-supporting points, and the beam may be fitted with more than one longitudinal arm to be articulately connected to the crane truck chassis. The whole without departing from the leading principle as set forth above, and as claimed hereinafter.

Claims

1. A crane truck with its chassis (1) being supported on at least one axle (6) fitted with wheels, particularly with steering wheels (5), characterized in that the axle (6), particularly the axle (6) that carries the steering wheels (5), is fitted with one or more longitudinal arms (14) which are articulately connected (at 13) to the chassis (1) so as to be allowed to oscillate about a horizontal axis extending transversally to the chassis (1), and about a median longitudinal axis, the chassis (1) being supported on the axle (6) through respective elastic suspension members (12), at two spaced apart points (107, 207) thereof.

2. The crane truck according to claim 1, characterized in that the axle (6) is fitted with only one median longitudinal arm (14) which is articulatingly connected to the chassis (1) at the vertical median longitudinal plane thereof, and the two points (107, 207) at which the chassis (1) is supported on the axle (6), are symmetrically disposed relative to the said median plane, and therefore relative to the barycenter of the said axle (6).
3. The crane truck according to claim 1 or claim 2, characterized in that the axle (6) on which the chassis (1) is supported, is the rear axle that carries the crane truck steering wheels (5).
4. The crane truck according to any one or more of the preceding claims, characterized in that the elastic suspension members (12) may be, for example, in form of helical spiral springs of steel, cylindrical spiral springs of rubber, hydraulic cylinders, or the like.
5. The crane truck according to any one or more of claims 1 to 3, characterized in that each elastic suspension member (12) provided in one point (107, 207) at which the chassis (1) is supported on the axle (6), is integrated into one single unit, in combination with an associated crane truck turnover-preventing device (26).
6. The crane truck according to claim 5, characterized in that the chassis (1) is connected to the axle (6) so as to be liftable away therefrom to a limited degree, each of the said units consisting of an elastic suspension member (12) and a crane truck turnover-preventing device (26) fitted with means (24) for limiting the upward travel of the chassis (1) from the axle (6).
7. The crane truck according to claim 5 or claim 6, characterized in that each elastic suspension member (12) consists of a set of springing discs (21) of an elastic material, preferably of rubber, plastics material, or the like, with a holding disc (22) of metal, preferably of steel, being interposed between every pair of successive springing discs (21).
8. The crane truck according to any one or more of claims 5 to 7, characterized in that the crane truck turnover-preventing device associated with each elastic suspension member (12), comprises an elastic member, for example in form of cup springs (126), which are interposed between the respective suspension

member (12) and the chassis (1), the said cup springs (126) being pre-loaded, with the crane truck in normal operative conditions, in the direction in which the chassis (1) is lifted away from the axle (6), to such a degree that when the crane truck load on the respective suspension member (12) has reached a predetermined minimum safety value surely preventing the crane truck from being turned over, the cup springs (12) will overcome the said load, and will lift the chassis (1) from the axle (6) to a limited safe extent.

9. The crane truck according to claim 8, characterized in that means (27) for detecting the upward travel of the chassis (1) from the axle (6), such as switches connected to a locking system against a crane truck turnover, are associated with the crane truck-turnover-preventing device (26).
10. The crane truck according to any one or more of the preceding claims, characterized in that the axle (6) is fitted with one connection stud (23) in each point (107, 207) at which the chassis (1) is supported, the chassis (1) being slidably mounted on the said connection studs (23), and the said connection studs (23) being provided at their upper end with preferably adjustable end-of-travel abutment means for limiting the upward travel of the chassis (1).
11. The crane truck according to claim 10, characterized in that the adjustable end-of-travel abutment means consist of: an abutment member (124), which is fitted on the upper end of each connection stud (23) and cooperates with the chassis (1), a shockproof pad (25) which is interposed between the chassis (1) and the abutment member (124), a split stop ring (224) which is placed on the abutment member (124), the said split stop ring (224) being fitted with means (324) for the said ring to be tightened on the connection stud (23).
12. The crane truck according to any one or more of the preceding claims 5 to 11, characterized in that the packs consisting of springing discs (21) and the interposed holding discs (22), are bored through their center and are threaded on the respective connection stud (23), the cup springs (126) forming part of the crane truck turnover-preventing device (26), being also threaded on the respective connection stud (23), and being received in a coaxial rigid bushing (226) which is interposed between the chassis (1) and the respective pack of discs (21, 22).

13. The crane truck according to any one or more of the preceding claims, characterized in that the chassis (1) and the axle (6) are interconnected by a link (18) which is arranged substantially in the transverse direction of the chassis (1), and is articulatingly connected by the one end to the chassis (1), and by the other end to the axle (6), so as to be allowed to oscillate chiefly in a vertical plane, and substantially in any directions.

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14. The crane truck according to claim 13, characterized in that the link (18) is eccentrically articulated with the axle (6), the point at which the link (18) is articulatingly connected to the chassis (1), being located on the opposite side of the chassis (1), relative to the median longitudinal axis thereof.

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15. The crane truck according to claim 13 or claim 14, characterized in that the ends of link (18) are each engaged through a ball bearing (20) with a longitudinally arranged, relative pivot (19), which is carried by ear pairs (307, 301), respectively provided on the axle (6) and the chassis (1).

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16. The crane truck according to any one or more of the preceding claims, characterized in that the means for articulatingly connecting the longitudinal arm (14) to the chassis (1) is in form of a horizontal pivot (15) extending transversally to the chassis (1), and being supported on the chassis (1) by a pair of plates (16), a vertical extension (114) of the longitudinal arm (14) being engaged through a ball bearing (17) with the said pivot (15).

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17. The crane truck according to any one or more of the preceding claims, characterized in that the axle (6) is in form of a transversally extending beam (7) fitted with the steering wheels (5) at the free ends thereof, and carrying the steering system (9, 10, 11), which is controllable from an operating cab (2), a longitudinal arm (14) being fastened by welding, or by means of possible stiffening plates (214) to the said beam (7), intermediately thereof, and the chassis being supported by its rear extension (101) on two separate points (107, 207) of beam (7).

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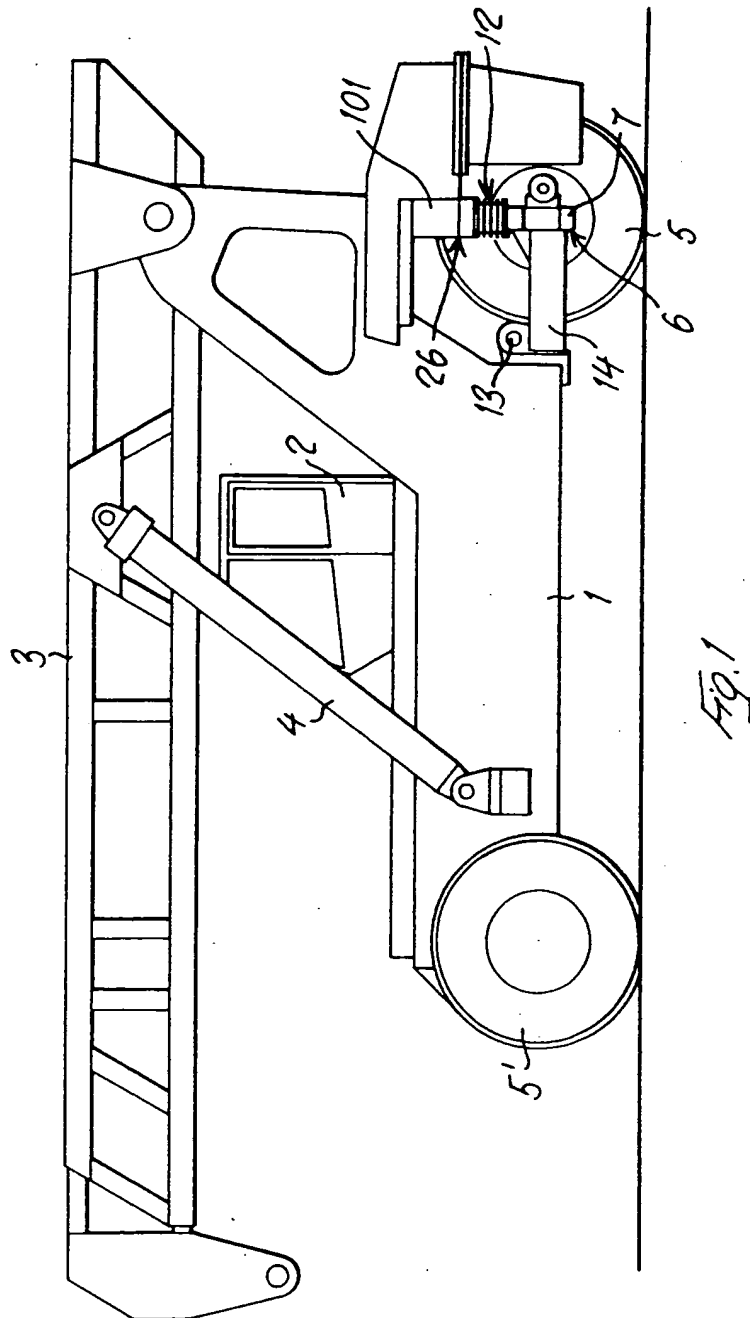
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18. The crane truck according to any one or more of the preceding claims, characterized in that the chassis (1) may be supported on the axle (6) at more than two points (107, 207), and an integrated unit comprising an elastic suspension member (12) and a crane truck turnover-

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preventing device (26), may be provided between the said axle (6) and the said chassis (1).



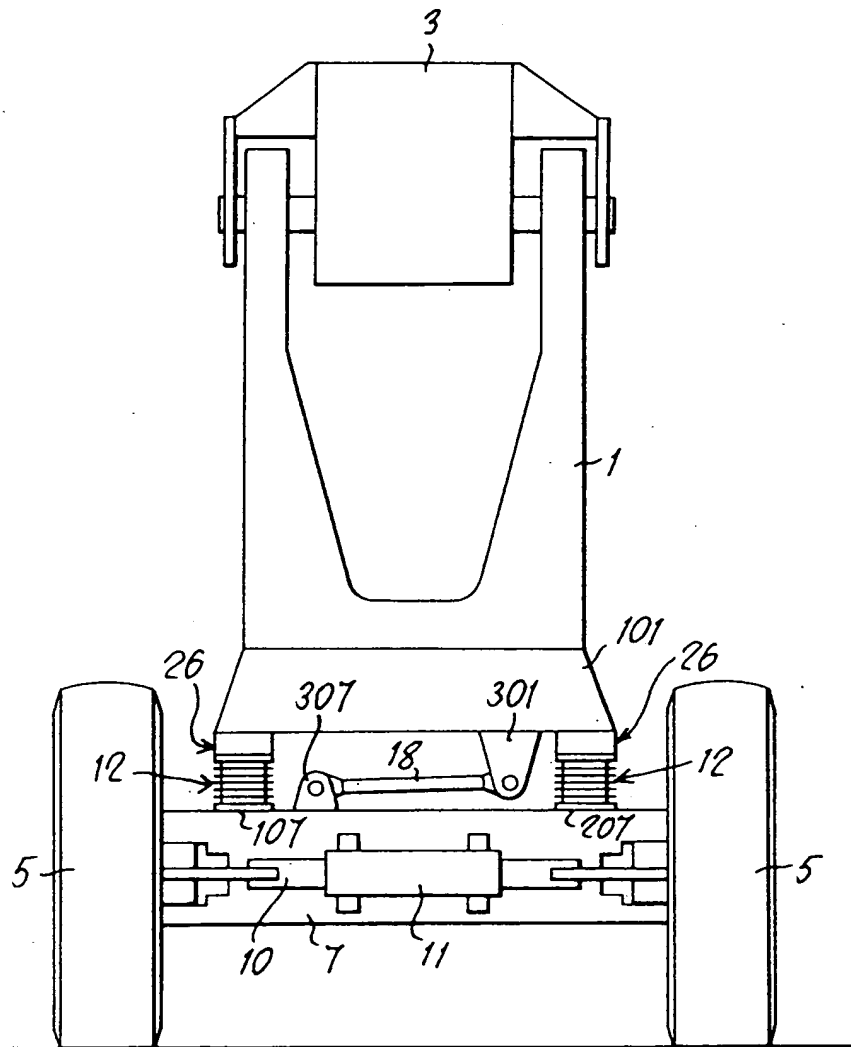
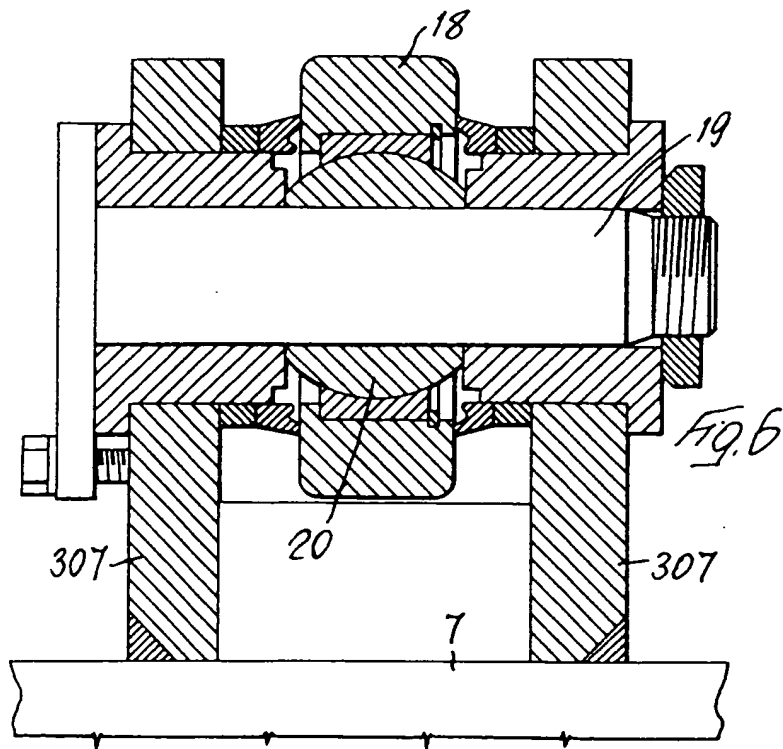
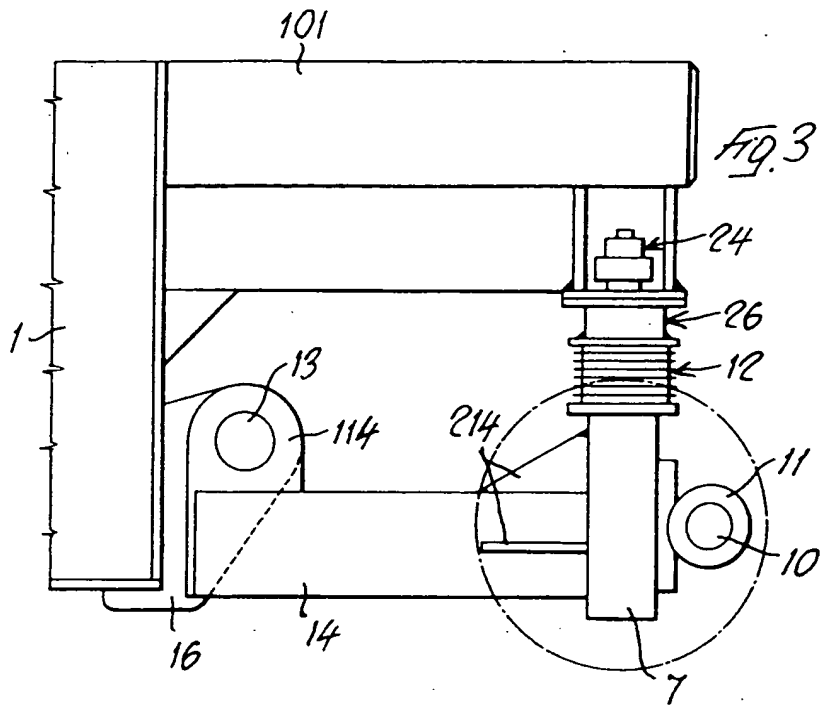
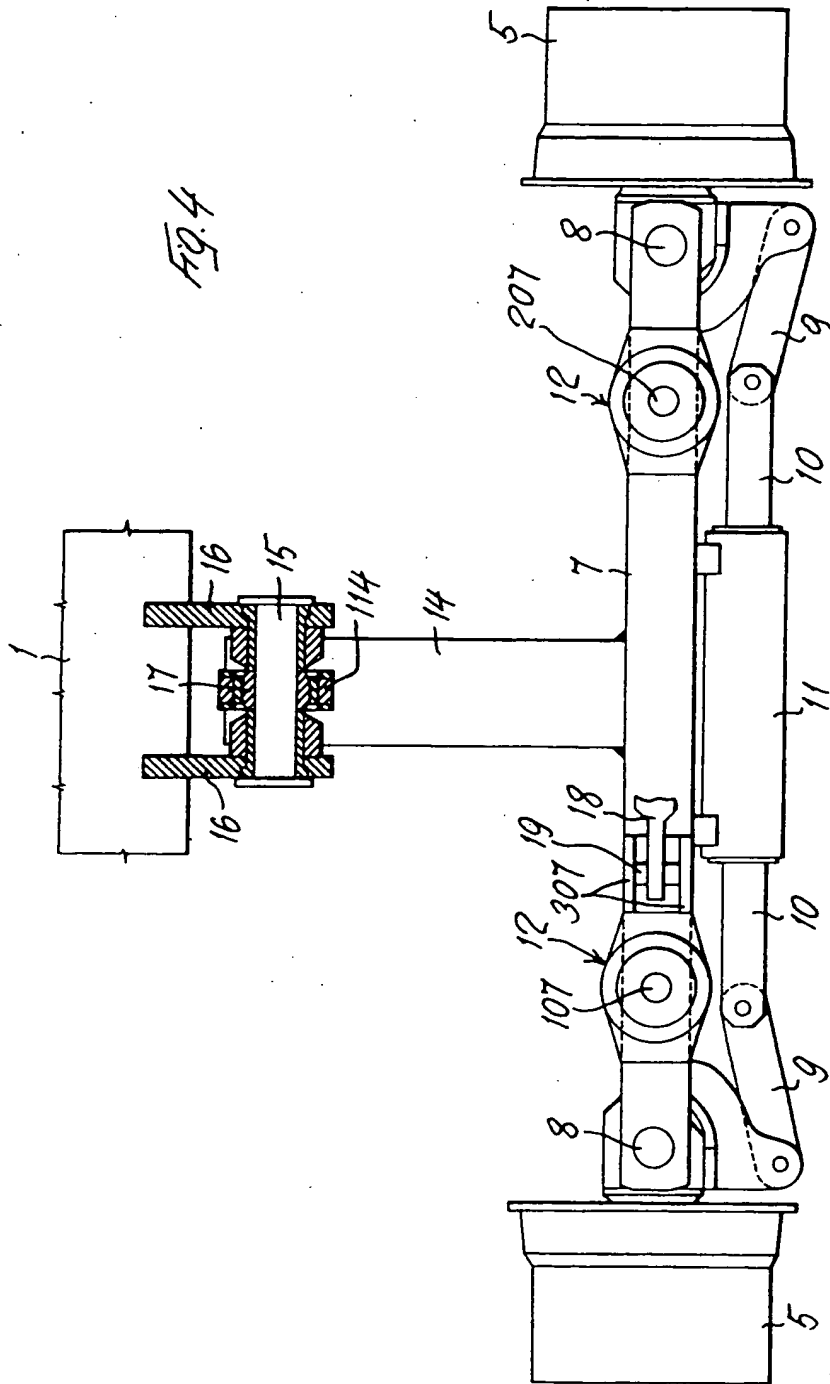
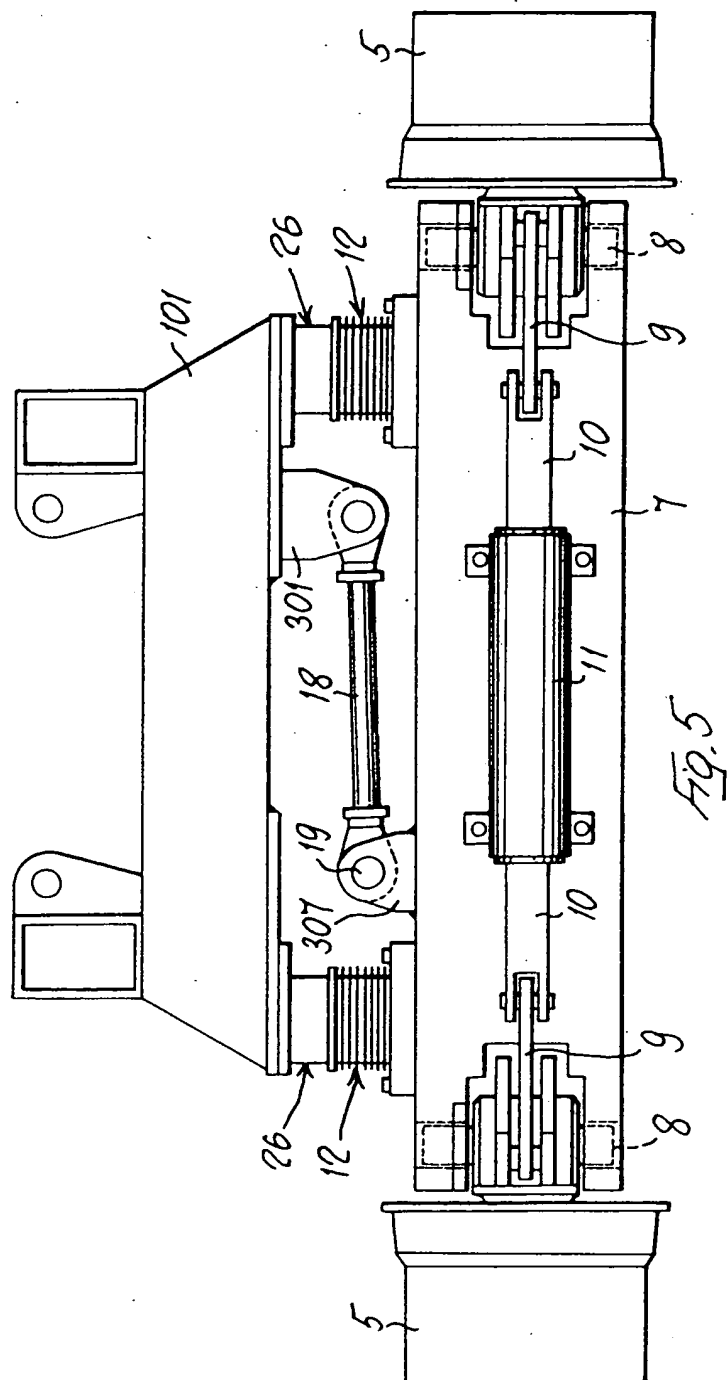
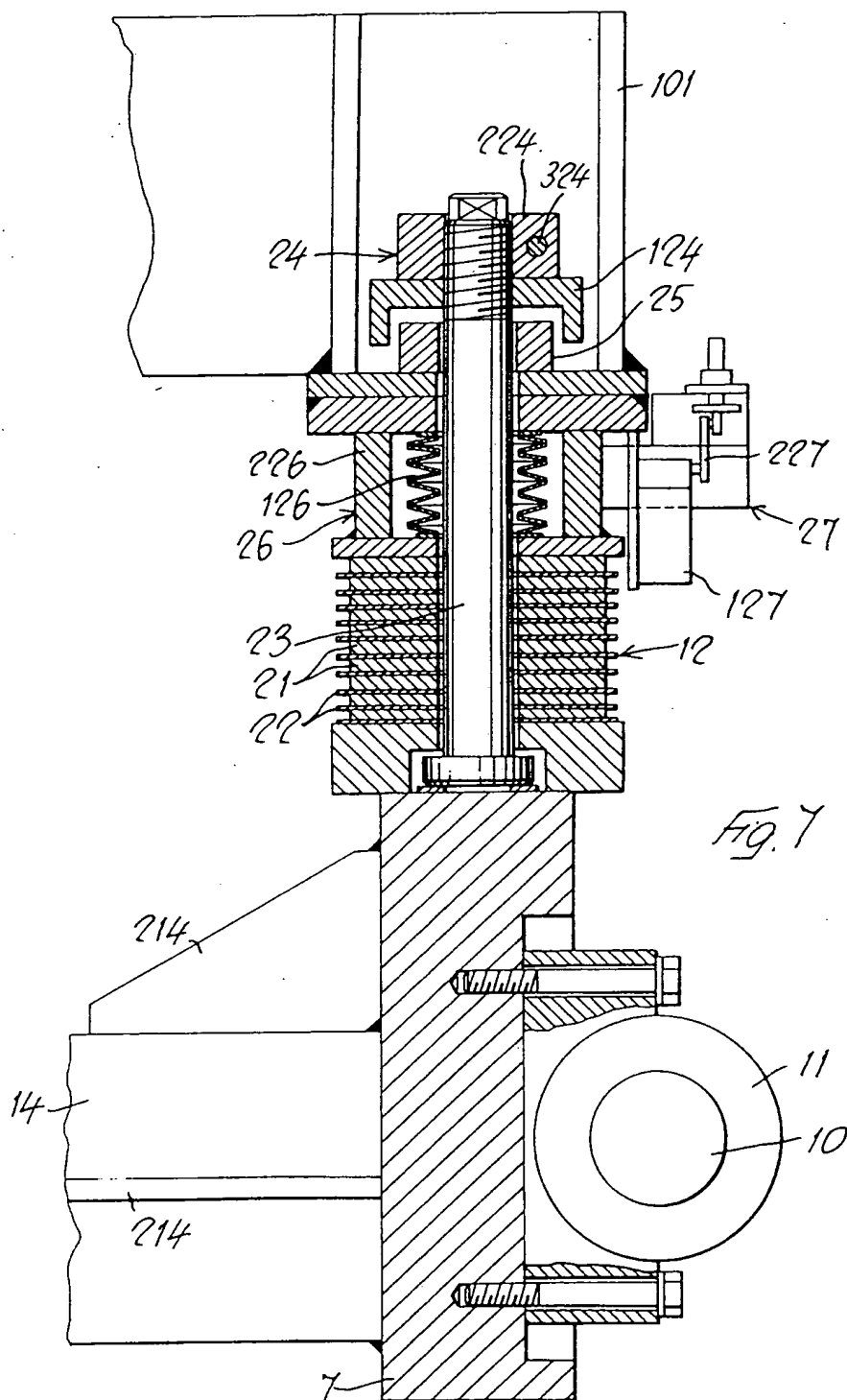


Fig. 2











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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 1944

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
Y	WD-A-8 905 742 (ZAHNRADFABRIK FRIEDRICHSHAFEN AG) * abstract; figures 1,2 *	1-4	B60G9/D2 F16F1/44 B60G11/48 F16F3/00
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Y	GB-A-2 056 382 (FIAT AUTO SPA) * the whole document *	1-4	
A	DE-A-1 430 166 (MASCHINENFABRIK AUGSBURG-NÜRNBERG AG) * figures 2,3 *	1,15,16	
A	US-A-4 683 970 (M.L.SMITH) * abstract; figure 1 *	1	
A	WD-A-8 101 689 (C.HART) * page 7, line 5 - line 10; figures 2,3 *	13,14	
A	US-A-1 453 525 (J.ROSS) * the whole document *	5,6,10	
A	US-A-4 756 512 (R.S.TOMS, JR.) * figures *	7	TECHNICAL FIELDS SEARCHED (Int. CL.5)
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A	FR-A-654 843 (VEREINIGTE STAHLWERKE AG)		
A	WD-A-8 702 628 (F.E.PARSONS)		
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	05 JUNE 1992	PEMBERTON P.	
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